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(71) Applicant(s)
Samsung Electronics Co Limited

(Incorporated in the Republic of Korea)

416 Maetan-dong, Paldal-gu, Suwon-city, Kyungki-do, Republic of Korea

(72) Inventor(s)
Yu-pyo Hong

(74) Agent and/or Address for Service
Dibb Lupton Alsop
Fountain Precinct, Balm Green, SHEFFIELD, S1 1RZ.
United Kingdom

(54) Quality control system

(57) A quality control system is supervised by a system control computer. A bar code printer issues product identification information in bar code form, according to information received from the system control computer, which bar code is then attached to a product in a production line. A number of failure code books contain various failure codes in bar code form, each failure code corresponding to a particular type of failure which can occur in the production process. Bar code scanners are used to scan the product identification information from the bar code attached to a product and a failure code from a failure code book when a failure occurs and pass the scanned information to the system control computer. The system control computer analyzes the scanned information and generates a production line stop signal when the scanned information satisfies predetermined production line stop conditions. In response to that signal, an alarm is activated.

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FIG. 1

(A)

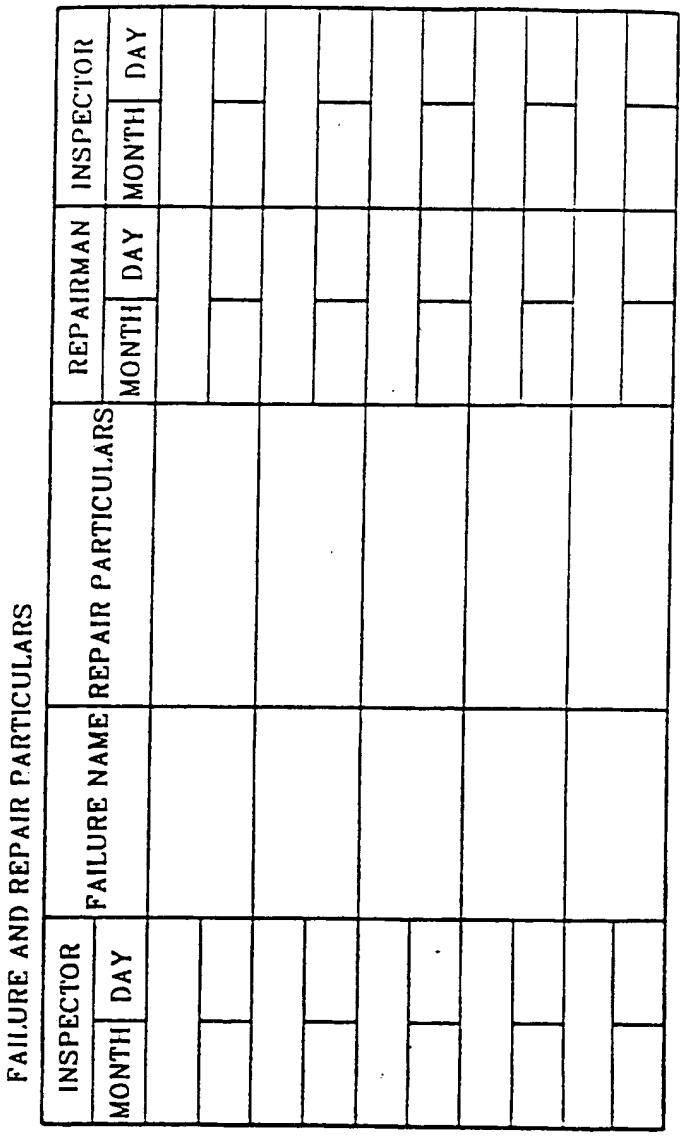


FIG. 1

(B)

HISTORY CARD

SET	MODEL NAME :
	SERIAL NO :

ASS' Y	MODEL NAME :
	SERIAL NO :

CHECKING SITUATION				
DIVIDE	CHECKING ITEMS		MONTH DAY	INSPECTOR
P B A	CHECK WITH NAKED-EYE			
	BOARD TEST			
	OPERATION TEST 1			
	OPERATION TEST 2			
FINISHED	OPERATION TEST	A		
		B		
	AGING TEST			
SENDING OUT	INTERNAL TEST			
	PERFORMANCE TEST			
	APPEARANCE TEST			

FIG. 2

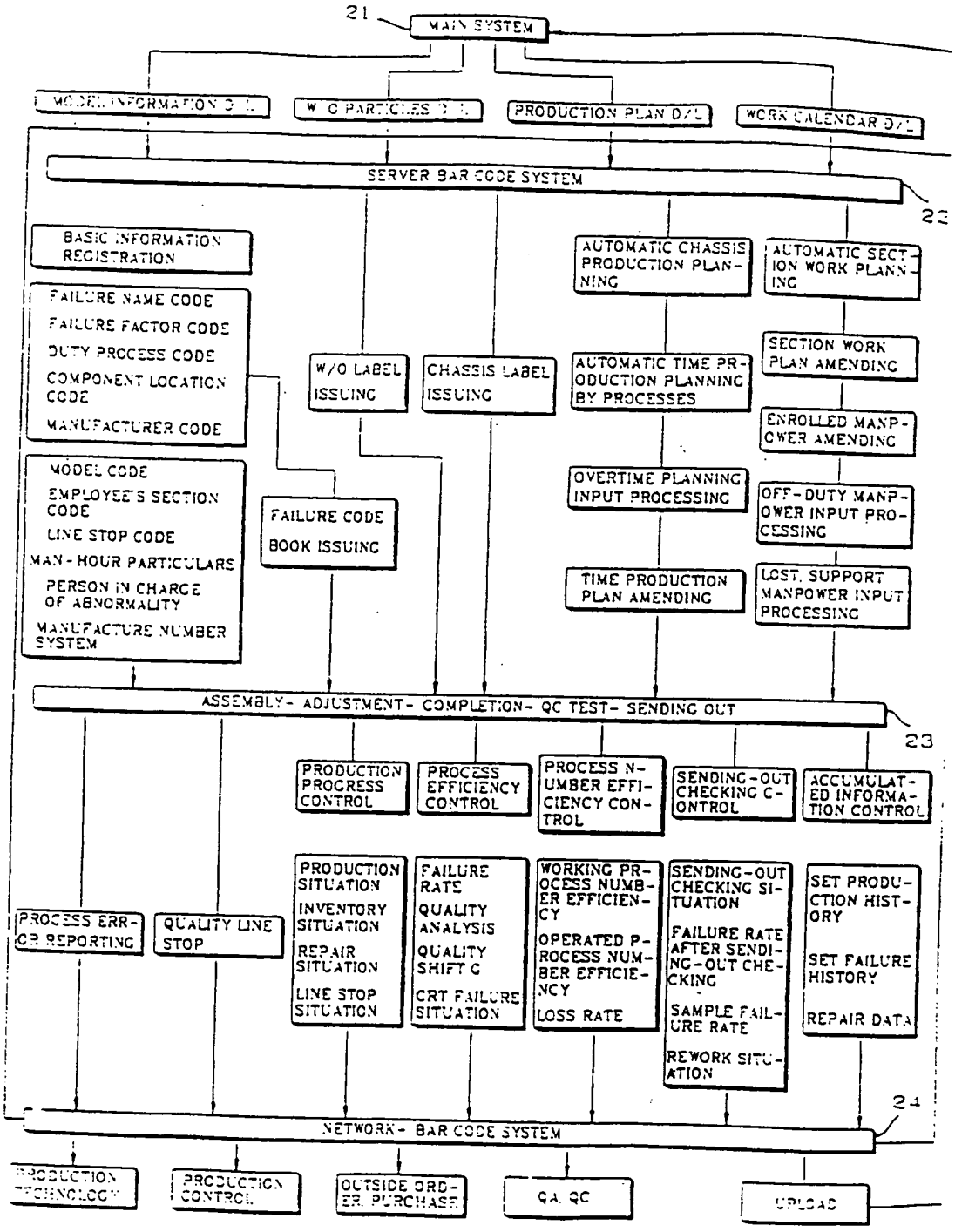

21
MAIN SYSTEM
MODEL INFORMATION D/L
W/O PARTICLES D/L
PRODUCTION PLAN D/L
WORK CALENDAR D/L
SERVER BAR CODE SYSTEM
22
BASIC INFORMATION REGISTRATION
FAILURE NAME CODE
FAILURE FACTOR CODE
DUTY PROCESS CODE
COMPONENT LOCATION CODE
MANUFACTURER CODE
MODEL CODE
EMPLOYEE'S SECTION CODE
LINE STOP CODE
MAN-HOUR PARTICULARS
PERSON IN CHARGE OF ABNORMALITY
MANUFACTURE NUMBER SYSTEM
W/O LABEL ISSUING
CHASSIS LABEL ISSUING
FAILURE CODE BOOK ISSUING
AUTOMATIC CHASSIS PRODUCTION PLANNING
AUTOMATIC SECTION WORK PLANNING
AUTOMATIC TIME PRODUCTION PLANNING BY PROCESSES
SECTION WORK PLAN AMENDING
ENROLLED MANPOWER AMENDING
OVERTIME PLANNING INPUT PROCESSING
OFF-DUTY MANPOWER INPUT PROCESSING
TIME PRODUCTION PLAN AMENDING
LOST, SUPPORT MANPOWER INPUT PROCESSING
ASSEMBLY- ADJUSTMENT- COMPLETION- QC TEST- SENDING OUT
23
PRODUCTION PROGRESS CONTROL
PROCESS EFFICIENCY CONTROL
PROCESS NUMBER EFFICIENCY CONTROL
SENDING-OUT CHECKING CONTROL
ACCUMULATED INFORMATION CONTROL
PROCESS ERROR REPORTING
QUALITY LINE STOP
PRODUCTION SITUATION
INVENTORY SITUATION
REPAIR SITUATION
LINE STOP SITUATION
FAILURE RATE
QUALITY ANALYSIS
QUALITY SHIFT C
CRT FAILURE SITUATION
WORKING PROCESS NUMBER EFFICIENCY
OPERATED PROCESS NUMBER EFFICIENCY
LOSS RATE
SENDING-OUT CHECKING SITUATION
FAILURE RATE AFTER SENDING-OUT CHECKING
SAMPLE FAILURE RATE
REWORK SITUATION
SET PRODUCTION HISTORY
SET FAILURE HISTORY
REPAIR DATA
24
NETWORK- BAR CODE SYSTEM
PRODUCTION TECHNOLOGY
PRODUCTION CONTROL
OUTSIDE ORDER PURCHASE
QA, QC
UPLOAD

FIG. 3

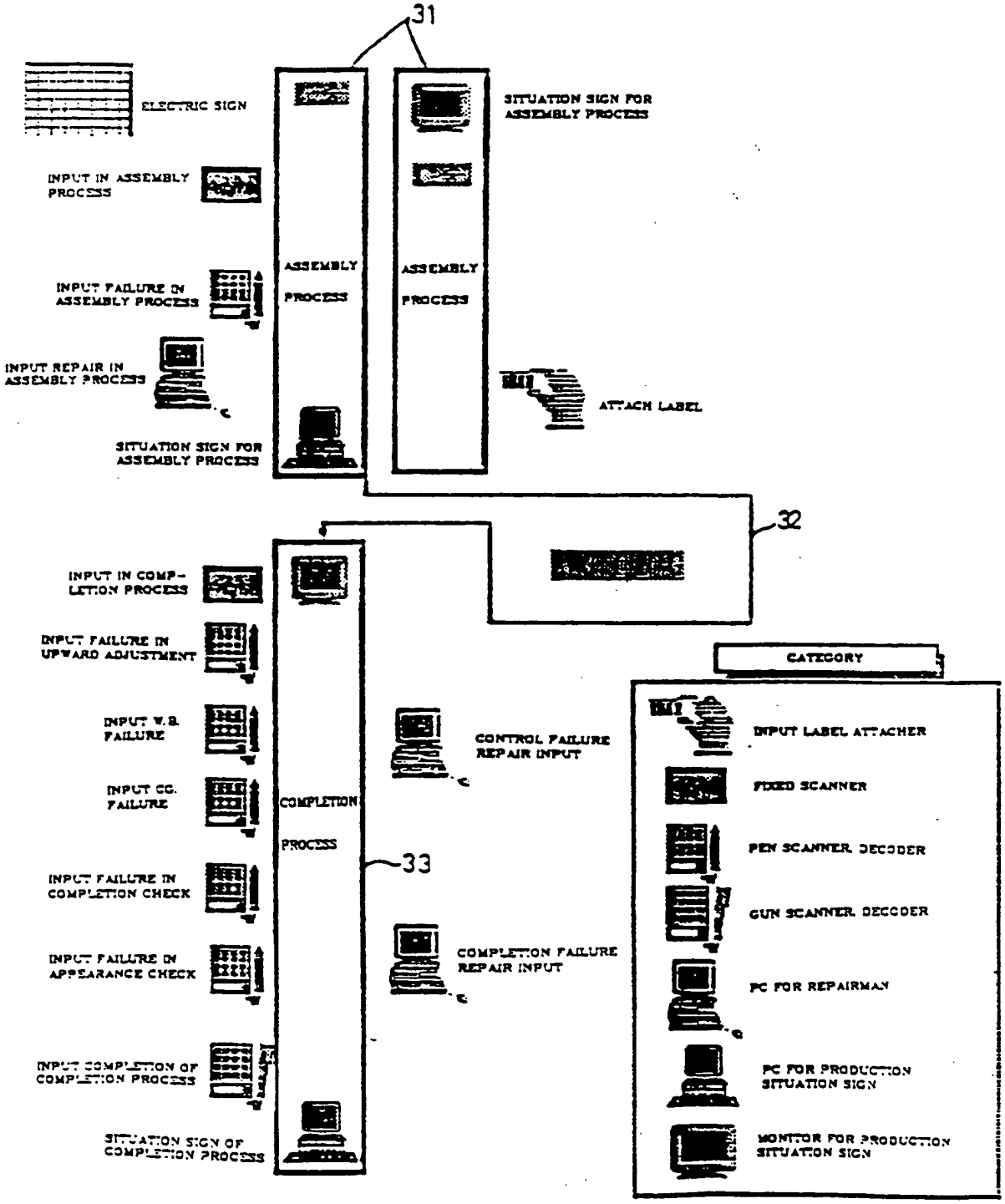

31
ELECTRIC SIGN
INPUT IN ASSEMBLY PROCESS
INPUT FAILURE IN ASSEMBLY PROCESS
INPUT REPAIR IN ASSEMBLY PROCESS
SITUATION SIGN FOR ASSEMBLY PROCESS
ASSEMBLY PROCESS
ASSEMBLY PROCESS
SITUATION SIGN FOR ASSEMBLY PROCESS
ATTACH LABEL
32
INPUT IN COMPLETION PROCESS
INPUT FAILURE IN UPWARD ADJUSTMENT
INPUT W.B. FAILURE
INPUT CG. FAILURE
INPUT FAILURE IN COMPLETION CHECK
INPUT FAILURE IN APPEARANCE CHECK
INPUT COMPLETION OF COMPLETION PROCESS
SITUATION SIGN OF COMPLETION PROCESS
COMPLETION PROCESS
33
CONTROL FAILURE REPAIR INPUT
COMPLETION FAILURE REPAIR INPUT
CATEGORY
INPUT LABEL ATTACHER
FIXED SCANNER
PEN SCANNER DECODER
GUN SCANNER DECODER
PC FOR REPAIRMAN
PC FOR PRODUCTION SITUATION SIGN
MONITOR FOR PRODUCTION SITUATION SIGN

FIG. 4

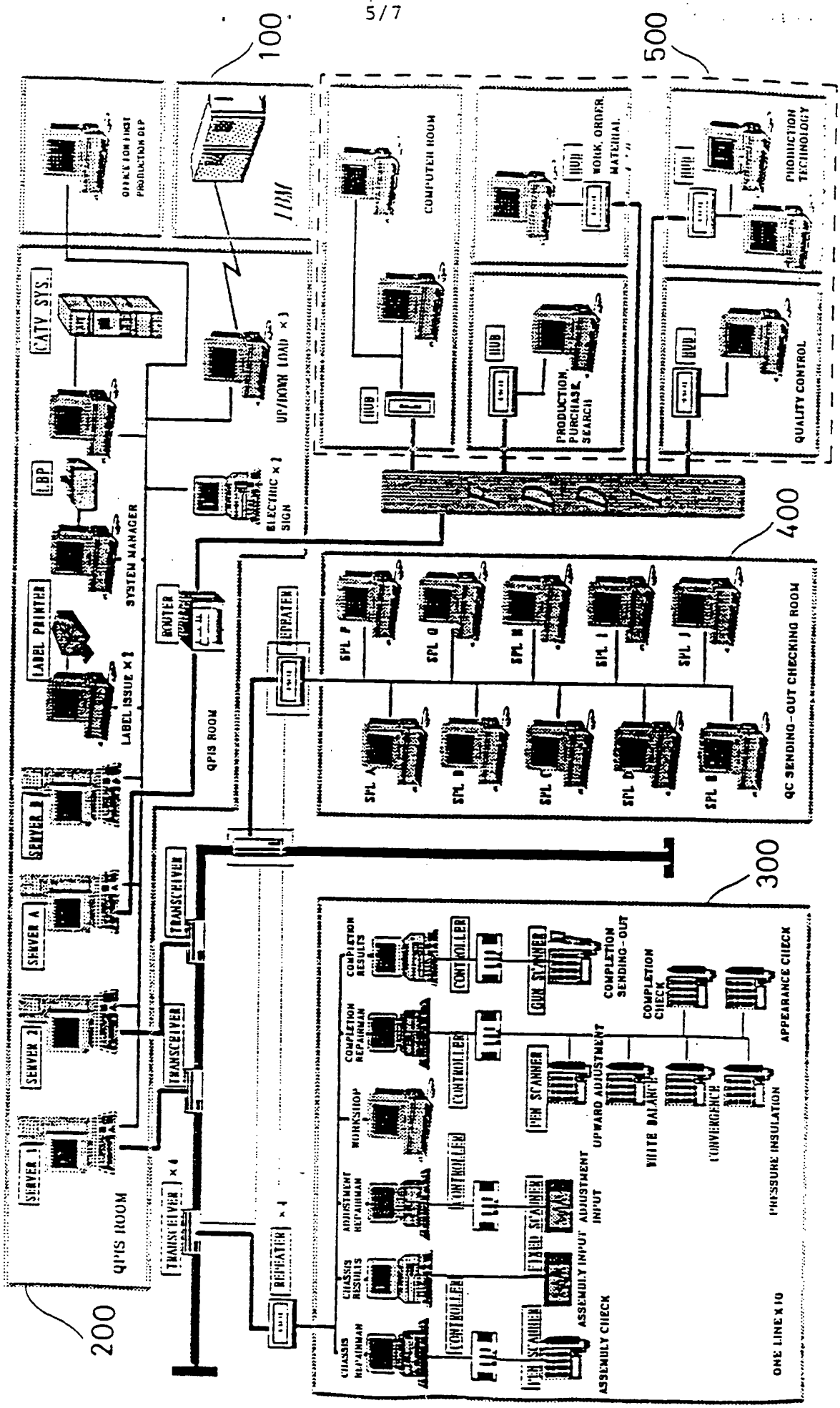

100
200
300
400
500
QPIS ROOM
SERVER 1
SERVER 2
SERVER 3
SERVER A
TRANSCEIVER
TRANSCEIVER × 4
REPEATER × 4
LABEL PRINTER
LABEL ISSUE × 2
SYSTEM MANAGER
LBP
CATV SYS.
ROUTER
REPEATER
QPIS ROOM
ELECTRIC × 2 SIGN
UP/DOWN LOAD × 2
OFFICE FOR FIRST PRODUCTION DEP
COMPUTER ROOM
HUB
PRODUCTION PURCHASE SEARCH
WORK ORDER MATERIAL
QUALITY CONTROL
PRODUCTION TECHNOLOGY
SPL A
SPL B
SPL C
SPL D
SPL E
SPL F
SPL G
SPL H
SPL I
SPL J
QC SENDING-OUT CHECKING ROOM
ONE LINE × 10
ASSEMBLY CHECK
CHASSIS REPAIRMAN
CHASSIS RESULTS
ADJUSTMENT REPAIRMAN
ADJUSTMENT INPUT
WORKSHOP
COMPLETION REPAIRMAN
COMPLETION RESULTS
CONTROLLER
PEN SCANNER
GUN SCANNER
UPWARD ADJUSTMENT
WHITE BALANCE
CONVERGENCE
PRESSURE INSULATION
COMPLETION CHECK
APPEARANCE CHECK
COMPLETION SENDING-OUT

FIG. 5

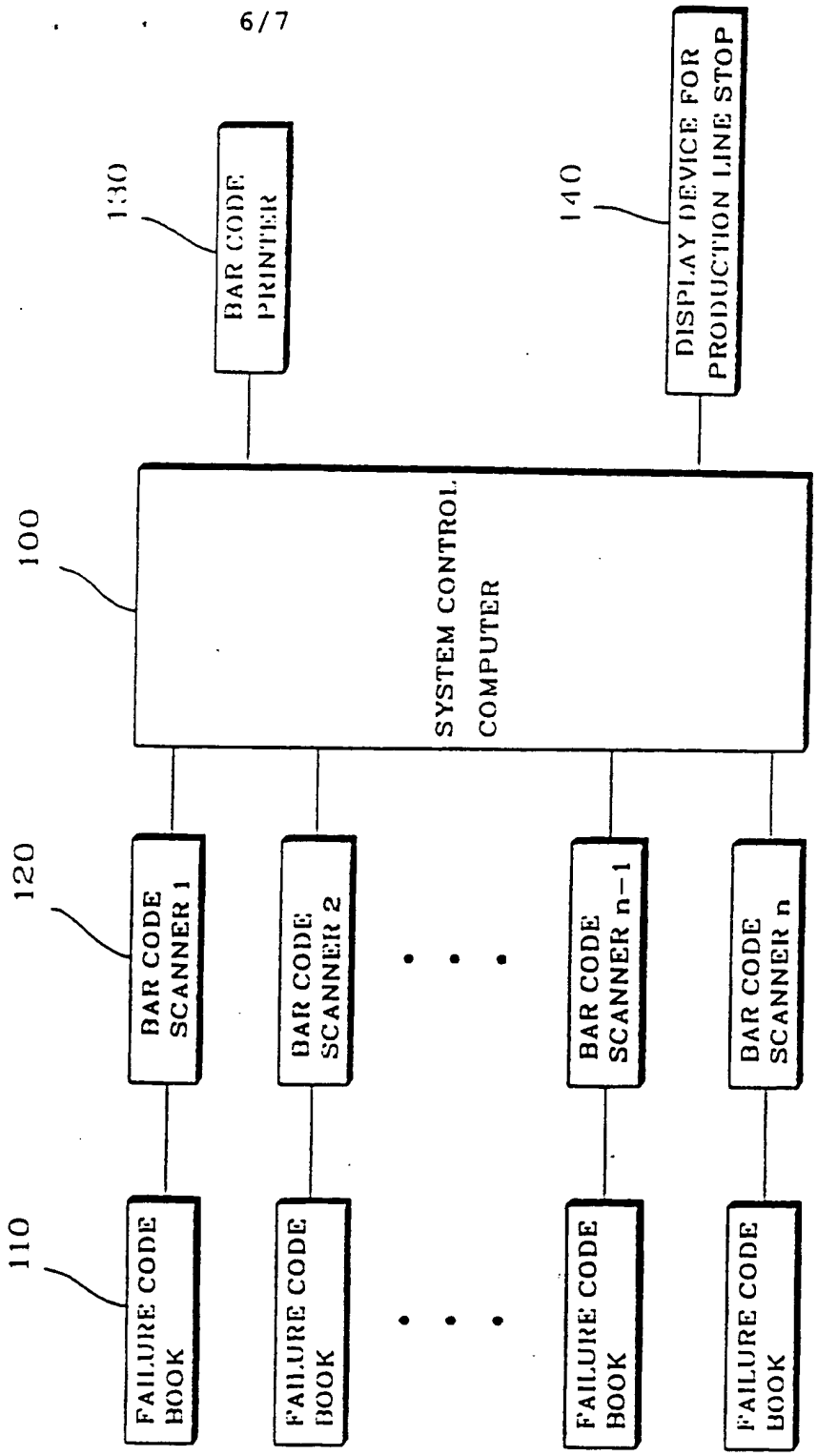
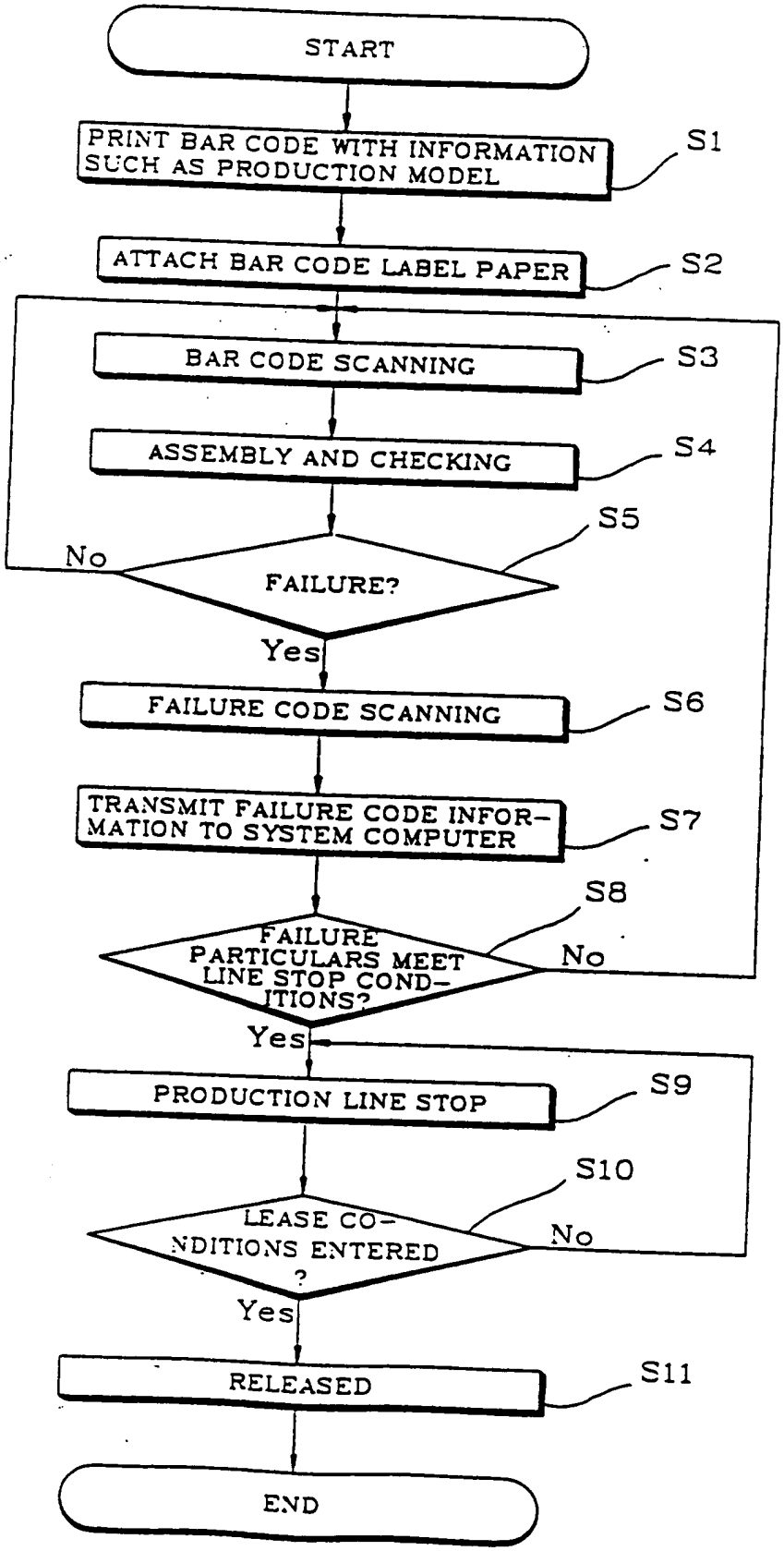

100
SYSTEM CONTROL COMPUTER
110
FAILURE CODE BOOK
120
BAR CODE SCANNER 1
BAR CODE SCANNER 2
BAR CODE SCANNER n-1
BAR CODE SCANNER n
130
BAR CODE PRINTER
140
DISPLAY DEVICE FOR PRODUCTION LINE STOP

FIG. 6


START
PRINT BAR CODE WITH INFORMATION SUCH AS PRODUCTION MODEL
S1
ATTACH BAR CODE LABEL PAPER
S2
BAR CODE SCANNING
S3
ASSEMBLY AND CHECKING
S4
S5
No
FAILURE?
Yes
FAILURE CODE SCANNING
S6
TRANSMIT FAILURE CODE INFORMATION TO SYSTEM COMPUTER
S7
S8
FAILURE PARTICULARS MEET LINE STOP CONDITIONS?
No
Yes
PRODUCTION LINE STOP
S9
S10
LEASE CONDITIONS ENTERED ?
No
Yes
RELEASED
S11
END

2314658

QUALITY CONTROL SYSTEM

BACKGROUND OF THE INVENTION

The present invention relates to a quality control system.

Many companies have made strenuous efforts to solve the difficult problems of the modern commodity markets such as stiff technical competition in the industry and consumer demands to survive in the struggle for existence through technical advancement, curtailment of costs and development of new products to meet consumer demands.

A high information system is attained by processing and transmitting various sorts of information collected in various areas with computers. Real-time collection of information has become an important problem in such information systems.

It is particularly difficult to accomplish real-time analysis for defective product rates form most manufacturers. Errors may also occur in the input process of information on the production rate of inferior quality articles.

FIG. 1 is a diagram illustrating a history card containing general checking and repair result particulars. The history card includes a model serial number, operational checking particulars and failure repairing particulars through a manual recording operation. Real-time collection of information is nearly impossible with this conventional technology, which depends on manual recording. Analysis for the related failures may be accomplished only after a period of time has elapsed.

Computer keyboards, OCRs (Optical Card Readers) and magnetic cards have been employed to solve the above-mentioned problems. The input process of information using these devices is based on the information transmitted

between a person and a machine. Accordingly, it has disadvantages in that an operator is required to input the information, errors in the input process are unavoidable and the input rate of the information is too slow. Voice recognition has been suggested as a new method of the input process, but its effectiveness is not yet proven.

An objective of the present invention is to provide a quality control system which improves product quality and allows the collection and processing of accurate information in real time.

SUMMARY OF THE INVENTION

Thus, a quality control system according to the present invention comprises:

a system control computer;

a bar code printer for issuing product identification information in bar code form, according to information received from the system control computer, for attachment to a product in a production line;

a plurality of failure code books containing a plurality of failure codes in bar code form, each failure code corresponding to a particular type of failure which can occur in the production process;

a plurality of bar code scanners for scanning the product identification information from the bar code attached to a product and a failure code from a failure code book when a failure occurs and passing the scanned information to the system control computer; and

the system control computer being adapted to analyze the scanned information and to generate a production line stop signal when the scanned information satisfies predetermined production line stop conditions;

an alarm which is activated by the production line stop signal.

The quality control method of the present invention comprises:

issuing product identification information in bar code

form and attaching it to an assembled or semi-assembled product in a production line;

scanning the product identification information from the bar code attached to the product and a failure bar code when a corresponding quality failure is found in the product;

analysing the scanned information and activating an alarm when the scanned information satisfies predetermined production line stop conditions.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

The present invention will now be described by way of example with reference to the accompanying drawings in which:

FIG. 1 is a diagram showing a history card containing general checking and repair result particulars;

FIG. 2 is a flow chart illustrating a data computing process according to the present invention;

FIG. 3 is a block diagram illustrating the assembly and checking processes according to the present invention;

FIG. 4 is a diagram showing the network of a bar code quality control system according to the present invention;

FIG. 5 is a detailed diagram showing the production section of the quality control system of FIG. 4; and

FIG. 6 is a flow chart illustrating the bar code quality control system according to the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

The bar code system which is used in the present invention is used in other areas and is a practical input means for information on defects. Bar codes are stable against unfavourable factors such as magnetic field, temperature and humidity. It is also readable with no contact and uses inexpensive labels. Thus it is easy to use in collecting information on the spot. Bar codes represent alphanumeric characters by a series of adjacent stripes of various widths, that is, a special combination of bars and spaces. A bar code reader is used to decode the bar code.

All sorts of information that has been processed with computers, for example, ID number of goods (model number, manufacture number and so on), output, order code and price may be recorded as bar code. Data comprising a special combination of bars and spaces is decoded by means of the bar code reader. A decoder is used to convert the data into numerals, characters and symbols such as `0-9', `A-Z', `.', `$', `/', `+', `%', `SPACE' and the like. The data which is adjusted to the special mode for a computer is entered in a main computer through the communication network via a system interface RS-232C (or RS-422).

The bar code system is preferred instead of other data input means because of following advantages.

First, the error rate when data is entered may be reduced by using the bar code system. A report on the LOGMARS PROJECT of the US Department of Defense indicated that bar code systems generated only four errors in 1,266,444 bar codes with an accuracy of 99.9997%, it is thus proved to be the most excellent data input system. Other data input systems exhibit relatively low accuracy, for example, 1/300 (99.7%) for a keyboard and 1/10,000 (99.99%) for an OCR.

Second, the data input process is simple. One or more characters, words or codes are entered at one time with a pen scanner or a gun scanner.

Third, the bar code system, which scans a bar code horizontally, can read even a damaged bar code because a bar code damaged by up to 95% of its height is readable horizontally. As for the OCR, the data input process is impossible with just 1% damage in any direction.

FIG. 2 is a flow chart illustrating a data computing process using a bar code system in accordance with the present invention. A server bar code system 22 receives information data such as model information, W/O (work/order) particulars or production plan from a host

computer 21 which controls the entire data computing process. The server bar code system 22 is in charge of registration of basic information, issue of failure code books and a W/O, production planning and work planning. It is connected to a production control system 23 which takes charge of production progress control, process quality control, process number efficiency control and sending-out checking control.

The production control system 23 is connected to a network bar code system 24 so as to transmit information to the sections related to production technology, outside order and purchase. The server bar code system 22 relates to the registration of basic information including failure name, failure factor, duty process, component location and manufacturer concerned. The production and work planning in the server bar code system 22 include production planning by processes, overtime planning, work planning by sections, enrolment figure input processes and day-off figure input processes.

The production control system 23 includes work particulars: production situation, inventory situation, repair situation and production line stop situation in the production progress control; defective rate, quality analysis and defective situation in the process quality control; working process number efficiency, operated process number efficiency and etc., in the process number efficiency control; and sending-out checking situation, sending-out checking rejection rate and rework situation in the sending-out checking control.

FIG. 3 is a block diagram illustrating assembly and checking processes of the above production control system according to the quality control system using the bar code system of the present invention. The assembling process 31 comprises issue of input labels and input processes of assembly process input, assembly process defective and assembly defective repair.

Assembled products must go through an ageing or hot burning process 32 which is a required process in the manufacture of electronic products so as to test the reliability of component elements. The ageing process is an endurance test of products against high temperature, high pressure and other unfavourable conditions. After the ageing process 32, products follow various tests 33, for example, in the case of a display device, an upward arbitration test, a white balance test, a perfection test, an appearance test and so on. When a failure is found out in the tests 33, the inspector records information on the related defective parts by means of a bar code scanner instead of a manual input means.

FIG. 4 shows the network of the quality control system using the bar code system according to the present invention. The network of the quality control system comprises a system control computer 100 for processing information of all manufacturing process lines and information about a production situation, a system control section 200 comprising a multitude of server computers and a bar code printer, a producing section 300 for processing the production yields and defective generated in the production process by means of a bar code scanner, a QC test room 400 for performing a quality test of the products manufactured through the producing section 300 and a production support section 500 for supporting production, purchase, quality control, outside order and production technology through data communications with the system control section 200. The data communications between the respective sections through LAN (Local Area Network) enable a real-time collection and statistic of information, so that we can make out an accurate production plan and production records.

Referring to FIG. 5 which shows the construction of the producing section 300 of FIG. 4, the producing section comprises a system control computer 100 for processing information of all manufacturing process lines and

information about a production situation, a bar code printer 130 for issuing a bar code record paper on which information such as the model name of a product introduced into the production line is printed, according to the information received from the system control computer 100, a multitude of failure code books 110 containing different sorts of failures occurring in the producing process in bar code forms, a multitude of bar code scanners 120 for reading out the bar code of the product with the bar code papers attached and reading failure codes on the failure code books when a failure occurs and a display device 140 for displaying a production line stop signal so as to make it recognized by a manufacturing worker or a supervisor when a defective rate is over a reference value, according to a control signal of the system control computer reading the failure code recognized by the bar code scanners 120.

A quality control method using the bar code system as constructed as above will now be described with reference to FIG. 6. The system control computer 100 stores aggregate information about output goals, production plan and material situation received from each section and the output of the bar code printer 130 is controlled according to information about production models and output goals by model (S1). The bar code label paper generated by the bar code printer 130 is attached to a special portion of a product (S2).

The bar-code-label-attached product is conveyed to a worker in charge of assembly and checking processes by means of a conveyor. Information about the product model provided in the assembly and checking process is transmitted to the system control computer by automatically scanning the bar code label paper attached to a special portion of a semi-assembled or assembled product on the conveyor which passes by a fixed scanner, with the fixed scanner (S3).

The worker assembles or inspects the product on the conveyor which approaches his location (S4). He scans the

bar code label attached to a special portion of the product to be assembled or checked by means of a pen scanner or a gun scanner (S5). The results of the scan are transmitted to each section through the LAN. The worker scans a normal code or a failure code recorded in the failure code book 110 in case of a defect on a half-finished product as a result of the assembly and checking processes (S6). This information is also transmitted to the system control computer 100 so as to store information about output results or failure particulars of the related model (S7).

If the failure particulars are over a reference defective value of the related model stored and accumulated in the system control computer 100, the computer 100 generates a production line stop signal so as to suspend further production. The worker can selectively stop the production line in case of a fatal failure or a serious problem which threatens the production line safety, irrespective of line condition.

The production line stop signal generated according to the control signal of the computer or the worker's request is applied to the display device 140 so as to inform the manufacturing worker or the supervisor that the defective rate is above a reference value or a condition requiring the production line to stop occurs.

For example, as for a reference value of the defective rate of a monitor, a production line stop signal is generated when the same failure occurs for two hours more than three times in circuit fields, or more than five times in apparatus fields, or totally more than six times in the circuit and apparatus fields. If the same failure occurs three times in succession for a day, or at least one safety failure occurs a day, the production line is suspended.

In case of a factor that satisfies the production line stop condition as described above, an alarm or a warning image on a display expresses the production line stop state so

that a manufacturing worker or a supervisor recognize the production line stop signal.

The production cannot be optionally started in the meantime. A warning light of red and yellow colours is repeatedly turned on or off, or an alarm is operated for one minute. There is no production result transmitted to the system control computer of the computing network (S9). An analysis for factors and a countermeasure are taken into consideration in a conference of sections related to a failure set security and production so as to cancel the above production line stop state. When the production line stop is released, a cancellation is performed by entering information such as a failure factor, a responsible section in charge, a person in charge and cancellation particulars in the computer network (S10).

After the completion of the cancellation, the production line is automatically in re-operation. The electric sign or a large-sized monitor, and the warning light and the alarm are returned to normal conditions. The output results henceforth are also entered in the computer (S11).

According to the present invention as described above, a bar code system is installed in the production line so as immediately to suspend the production line in case of a situation corresponding to production line stop conditions, thereby preventing repeated occurrences of the same failure and providing information such as the production situation and the failure situation in real time.

CLAIMS

1. A quality control system comprising:

a system control computer;

a bar code printer for issuing product identification information in bar code form, according to information received from the system control computer, for attachment to a product in a production line;

a plurality of failure code books containing a plurality of failure codes in bar code form, each failure code corresponding to a particular type of failure which can occur in the production process;

a plurality of bar code scanners for scanning the product identification information from the bar code attached to a product and a failure code from a failure code book when a failure occurs and passing the scanned information to the system control computer; and

the system control computer being adapted to analyze the scanned information and to generate a production line stop signal when the scanned information satisfies predetermined production line stop conditions;

an alarm which is activated by the production line stop signal.

2. A quality control system according to claim 1 in which the bar code scanners include fixed bar code scanners for the product bar codes and pen-type scanners for the failure codes.

3. A quality control method comprising:

issuing product identification information in bar code form and attaching it to an assembled or semi-assembled product in a production line;

scanning the product identification information from the bar code attached to the product and a failure bar code when a corresponding quality failure is found in the product;

analysing the scanned information and activating an alarm when the scanned information satisfies predetermined

CLAIMS

1. A quality control system comprising:

a system control computer;

a bar code printer for issuing product identification information in bar code form, according to information received from the system control computer, for attachment to a product in a production line;

a plurality of failure code books containing a plurality of failure codes in bar code form, each failure code corresponding to a particular type of failure which can occur in the production process;

a plurality of bar code scanners for scanning the product identification information from the bar code attached to a product and a failure code from a failure code book when a failure occurs and passing the scanned information to the system control computer; and

the system control computer being adapted to analyze the scanned information and to generate a production line stop signal when the scanned information satisfies predetermined production line stop conditions;

an alarm which is activated by the production line stop signal.

2. A quality control system according to claim 1 in which the bar code scanners include fixed bar code scanners for the product bar codes and pen-type scanners for the failure codes.

3. A quality control method comprising:

issuing product identification information in bar code form and attaching it to an assembled or semi-assembled product in a production line;

scanning the product identification information from the bar code attached to the product and a failure bar code when a corresponding quality failure is found in the product;

analysing the scanned information and activating an alarm when the scanned information satisfies predetermined

production line stop conditions.

4. A quality control method according to claim 3 in which the scanned information is transmitted to a system control computer which determines whether the production line stop conditions are satisfied and, if so, generates a production line stop signal which activates the alarm.

5. A quality control method according to claim 3 or claim 4 in which the product bar codes are scanned using a fixed scanner and the failure codes are scanned by a pen-type scanner.

6. A quality control method according to any one of claims 3-5 in which the production line is stopped in response to the alarm.

7. A quality control method according to claim 6 further comprising releasing the production line for normal operation when predetermined release conditions have been satisfied.

8. A quality control system or method according to any preceding claim in which the product identification information includes the production model of the product.

9. A quality control system or method according to any preceding claim in which the alarm includes an audible siren.

10. A quality control system or method according to any preceding claim in which the alarm includes a display device.

11. A quality control system or method according to claim 10 in which the display device comprises a warning light.

12. A quality control system or method according to claim 11 in which the warning light is repeatedly turned on and

off.

13. A bar code quality control system substantially as described with reference to and/or as illustrated in FIGs. 2 et seq. of the accompanying drawings.

14. A bat code quality control method substantially as described with reference to and/or as illustrated in FIGs. 2 et seq. of the accompanying drawings.

Patent Office

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Application No: GB 9713702.0
Claims searched: 1-14

Examiner: Mike Davis
Date of search: 18 August 1997

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): G4H (HJ)

Int Cl (Ed.6): G06K, G06F

Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
	None	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.